Test Two Guide

The test will cover chapters 6,7 and 8. As such, it will go from structures in the cell, both plant and animal, membranes in the cell and how they are part of one continuous system, energy and enzymes. You also should expect a question that lets you talk about the cell you studied and probably one that has to do with chi-square analysis and water potential.

1. Even though we have spent most of our time looking at eukaryotic cells, you should know the difference between prokaryotic (archaea and bacteria) and eukaryotic. There are many.

    1.1. Prokaryotes don't have internal organelles surrounded by membranes: no nucleus, ER or golgi. They do have a cell membrane (plasma membrane). DNA is stored in a protein-rich structure known as the "nucleoid."

    1.2. They generally have a much lower amount of DNA and they have one circular chromosome

    1.3. There are key differences in metabolism we exploit with drugs: antibiotics that target bacteria, but don’t kill our own cells.

2. Know the names of the basic structures of the eukaryotic cell. But, more importantly, know what they they do and what the implications of that are. You may be called upon just to know a name. However, you will be more likely to see a question that requires you to think about function.

    2.1. So, what would happen if an organism had a mutation to a protein in desmosomes?

    2.2. How would that be different from a mutation to gap junctions?

    2.3. Know the components of the cytoskeleton and the various ways they are used. For example, a mutation affecting a microtubule motor might affect male fertility (by limiting flagellar motion) and transport of vesicles in a cell. A mutation affecting intermediate filaments might alter the structure of cells, but also might have effects on hair and fingernails. I love questions that tie the various roles of certain proteins together.

3. When it comes to membranes, know that the mitochondria and chloroplast membranes are NOT part of the endo-membrane system. Be able to interpret data about that system. For example, we can follow radioactive lipids or proteins as they move through the system. Some common facts that get missed:

    3.1. the nucleus has a double membrane (two lipid bilayers)

    3.2. the inside face of the plasma membrane is different from the outside face.

    3.3. the inside of the ER, Golgi and vesicles are all continuous with the OUTSIDE of the cell.

    3.4. Many proteins are NOT associated with membranes or secreted. These are made by “free ribosomes” and are found in the cytosol.

4. Membrane permeability and transport: Know the difference between active and passive transport; the role of channel proteins, pumps, facilitated diffusion, cotransport etc. Also know about bulk transport.

5. Electrochemical gradients across membranes are very important. You should know some examples of pumps that establish them (such as the sodium/potassium pump we discussed). Presented with a diagram of a transport system, you should be able to analyze how it works and what would happen if something went wrong with it (similar to the BASS2 activity, but not as complex). I may show you a transport system you have not seen. Be able to make sense of the diagram anyway. Remember, the names of the proteins are not that important. Knowing how gradients are established and how they can be used to do work is important.

6. Energy: know the terms endergonic and exergonic and what they mean. Know that the laws of thermodynamics are never broken in biology. Reactions are always moving in the spontaneous direction as required by the second law. It's just that they never get to equilibrium as new reactants come into the system and heat is passed to the universe. Understand the idea of coupling unfavorable reactions to favorable ones, so that some molecules can gain in potential energy while the whole system still has a negative delta G (thinks about the FSU teeterboard show). Remember, no single reaction takes place all by itself. Essentially all of the reactions in a cell are connected to the other reactions ("products" of one are the "reactants" of another and that reactions can go both directions with very few exceptions.

7. Water Potential and Osmosis. Since we haven't finished the lab writeup yet, you will not be expected to do much with this. But, you should be able to use the equation in a simple way. It will be provided if needed. You don't need to memorize it.

    7.1. Know which way water will move given a description of conditions (hypotonic or hypertonic solutions

    7.2. Know what happens to animal and plant cells under hypertonic, hypotonic or isotonic conditions

    7.3. Understand why distilled water won't keep going into a plant cell indefinitely (there is pressure built up inside the cell). Osmotic equilibrium in a plant cells is reached when water's tendency to move into the cell because of *solvent* potential (ψ_s) is exactly balanced by *pressure* potential (ψ_p). So, $\psi_p=\psi_s$ when equilibrium is reached. $\psi_w=0$).